Forces in Motion

Use Newton's laws to explain everyday changes in motion.

PS.8.b "motion is described by Newton's laws."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the statement of each Newton's law and write 1, 2, or 3 beside it. Circle each example that shows a force changing motion.

Pushes, Pulls, and Motion

1. Newton's laws help scientists describe motion and changes in motion. The first law says an object at rest stays at rest, and a moving object keeps moving at the same speed and direction, unless a net force acts on it. A net force is the overall push or pull after all forces are combined. On a smooth air-hockey table, a puck glides until friction or a player's stick changes its motion. Friction is a force that opposes motion.

2. The second law connects force, mass, and acceleration. Acceleration is a change in speed or direction. For the same object, a larger net force produces a larger acceleration. For the same force, an object with more mass accelerates less. Imagine two empty shopping carts, then one cart loaded with bags. An equal push makes the empty cart speed up more. To give the loaded cart the same acceleration as the empty cart, a shopper must use more force.

3. Newton's third law describes force pairs. When one object pushes or pulls on another object, the second object pushes or pulls back with an equal force in the opposite direction. The two forces act on different objects, so they do not cancel each other. A swimmer pushes water backward with her hands and feet. The water pushes the swimmer forward. Each force in this pair happens at the same time, even if the objects move differently because their masses differ.

2 ANSWER WITH EVIDENCE

Use the passage

1. What must act on a moving object before its speed or direction changes?

2. Two carts receive equal pushes. Which cart accelerates more, the empty cart or the loaded cart? Use mass in your answer.

3. What must the shopper do to give the loaded cart the same acceleration as the empty cart?

4. In the swimmer example, identify the two forces in the third-law pair. Why do they not cancel each other?

3 YOUR TURN

Your own words

Invent a schoolyard or home motion situation. Write three labeled sentences, one for each of Newton's laws, that name the objects and explain the forces or motion.

ANSWER KEY

Forces in Motion

GRADES 7-8 · PS.8.b

PART 1 · READ AND MARK

Underline the statement of each Newton's law and write 1, 2, or 3 beside it. Circle each example that shows a force changing motion. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What must act on a moving object before its speed or direction changes?	**A net force must act on it.**
2	Two carts receive equal pushes. Which cart accelerates more, the empty cart or the loaded cart? Use mass in your answer.	**The empty cart accelerates more because it has less mass.**
3	What must the shopper do to give the loaded cart the same acceleration as the empty cart?	**The shopper must use more force.**
4	In the swimmer example, identify the two forces in the third-law pair. Why do they not cancel each other?	**The swimmer pushes the water backward, and the water pushes the swimmer forward. The forces do not cancel because they act on different objects.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Law 1: Before a player kicks a soccer ball, the ball stays at rest until the kick gives it a net force. Law 2: With equal kicks, a light practice ball accelerates more than a heavier ball because it has less mass. Law 3: A runner's foot pushes the ground backward, and the ground pushes the runner forward with an equal force in the opposite direction.

Accept equivalent descriptions that correctly connect Newton's first law to net force, second law to force, mass, and acceleration, and third law to equal and opposite forces on different objects. For Part 3, each labeled sentence should accurately apply the named law to a student-created situation.